Is Sharpe's Longclaw *Macronyx sharpei* a fire-dependent species in Kenya's Altimontane zone?

Luca Borghesio[a,b], Muchai Muchane[b], Kariuki Ndang'ang'aa[c] and Peter Njoroge[b]

La Sentinelle de Sharpe *Macronyx sharpei* est-elle une espèce dépendante du feu dans la zone afroalpine du Kenya? La Sentinelle de Sharpe *Macronyx sharpei* est une espèce endémique du Kenya classée comme « Menacée d'extinction » et restreinte aux prairies à buttes au-dessus de 1.900 m. L'espèce a été étudiée sur la partie la plus basse de sa distribution altitudinale (1.900–2.500 m), mais les données provenant d'altitudes plus élevées n'ont pas été confirmées depuis plusieurs décennies. Les résultats sont rapportés d'un recensement réalisé en août 2008 et mars–juillet 2009 dans des habitats de haute altitude des Parcs Nationaux du Mont Kenya, du Mont Elgon et d'Aberdare et leurs environs. La Sentinelle de Sharpe a été observée sur le Mont Elgon (deux individus à 3.490 m) et le Mont Kenya (trois à 3.592 m), mais la densité des populations était faible (0.21 individus / ha), indiquant que l'habitat est suboptimal. Les auteurs ont trouvé maintes indices que les prairies sont envahies par des arbustes en de nombreux endroits et il est possible qu'une gestion du feu sera nécessaire pour conserver ces habitats sur les montagnes du Kenya. Des recherches complémentaires sont requises afin de mieux estimer la taille de la population de la Sentinelle de Sharpe sur les massifs de haute altitude du Kenya et d'y tester l'hypothèse de sa dépendance du feu.

Summary. Sharpe's Longclaw *Macronyx sharpei* is an Endangered Kenyan endemic, restricted to tussock grasslands above 1,900 m. The species has been studied at the lower end of its altitudinal range (1,900–2,500 m), but records from higher elevations have not been confirmed for several decades. We report the results of a survey undertaken in August 2008 and March–July 2009 in high-altitude habitats in and around Mount Kenya, Mount Elgon and Aberdare National Parks. We recorded Sharpe's Longclaws on Mount Elgon (two at 3,490 m) and Mount Kenya (three at 3,592 m), but population densities were low (0.21 individuals / ha), suggesting the habitat is suboptimal. We found widespread evidence of grassland being encroached by shrubs, and hypothesise that appropriate fire management might be required to maintain such habitats in Kenya's high mountains. More research is required to better estimate the size of Sharpe's Longclaw populations in Kenyan high montane massifs and to test the hypothesis of its fire-dependence there.

Sharpe's Longclaw *Macronyx sharpei* is endemic to a small range in central and western Kenya (Zimmerman *et al.* 1996). It is a habitat specialist, restricted to open, treeless, high-altitude grassland with short, tussocky grass. Patches with long (>30 cm) grass support a markedly smaller number of territories, and grass tussocks are essential, because adults use them for nesting, lookout and shelter (Muchai *et al.* 2002). Moreover, tussocks might also represent key foraging sites because pecking rates of foraging adults are higher close to them (Muchai *et al.* 2002). It has been suggested (Muchai *et al.* 2002) that the persistence of Sharpe's Longclaw in a grassland depends on intermediate levels of disturbance, which is caused by the grazing of mammalian herbivores (mainly domestic sheep and cows). Low grazing intensity will result in long grass and bush encroachment, whilst too intense grazing will destroy grass tussocks. In both cases, habitat quality for Sharpe's Longclaw will be negatively affected. Therefore, appropriate habitat management is of central importance for the conservation of Sharpe's Longclaw.

Territory size usually varies between 0.4 and 5.6 ha; smaller territories indicate better habitats (Muchai *et al.* 2002). Sharpe's Longclaw is also sensitive to landscape characteristics, as territory density, even in appropriate tussock grassland, decreases when patches become smaller than 20 ha and are embedded in an inhospitable matrix of crops or tree plantations (Lens *et al.* 2001).

The altitudinal distribution ranges from *c.*1,850 to >3,500 m (BirdLife International 2012), but it is markedly bimodal, because on Kenyan mountains the belt between 2,600 and 3,000 m tends to be occupied by forests. Most records of Sharpe's Longclaw come from altitudes below 2,600 m. The few observations from above the forest belt originate from the three

highest massifs in Kenya, namely the Aberdare Range, Mount Kenya and Mount Elgon. All were obtained more than 40 years ago (Meinertzhagen 1937, Britton & Sugg 1973), with no recent confirmation of the species' continued presence at such high elevations, from what White (1983) termed the Altimontane (=Afroalpine) zone, where a mosaic of ericaceous shrubland, elfin thicket and (sub-)alpine grassland is maintained in a shifting equilibrium by fire, herbivore grazing and harsh climate (Young 1996).

Sharpe's Longclaw is a globally threatened species, currently classified as Endangered under IUCN criteria (BirdLife International 2012). The main threat is habitat destruction, because most of its habitat is prime agricultural land. On the Kinangop plateau, the species' main stronghold, earlier estimates (Ndang'ang'a *et al.* 2002) suggest that by the year 2012, grassland might occupy less than 20% of its former extent, with most of the remaining patches too small to support viable territories. Rapid conversion of natural grassland to agriculture has also been observed at other sites, such as Molo-Mau Narok (Ndang'ang'a *et al.* 2003) and Uasin Gishu (BirdLife International 2012). This problem is exacerbated by the fact that almost all of the grassland below the forest belt is privately owned farmland with no official protection. Only at the highest end of its altitudinal range might Sharpe's Longclaw occur inside protected areas, because the Aberdare Range, Mount Kenya and Mount Elgon are national parks. Unfortunately, with no recent records from these three mountains, it is impossible to know whether Sharpe's Longclaw still persists inside protected areas, or, if it does, what conservation management might be appropriate. This issue is important because the ecology of Altimontane grasslands differs from that of lower altitude sites, where Sharpe's Longclaw has been studied in more detail. At lower altitudes, grasslands are currently maintained by grazing of domestic herbivores, while above 3,000 m only wild herbivores occur and grazing intensity is lower. Also, fires regularly occur in Altimontane grasslands (Young 1996) unlike at lower altitudes, where landowners attempt preventive measures.

Here we report on preliminary surveys of the three Altimontane areas where Sharpe's Longclaw was recorded in the past. Our objectives were to confirm the species' continued presence at these sites, to obtain preliminary information on its population, and to assess possible threats and management issues that are specific to high-altitude populations.

Study areas and Methods

Field work was undertaken in alpine habitats (>2,700 m) in Aberdare (8–9 August 2008) and Mount Elgon (12 September 2009) National Parks. Birds were counted walking at *c.*2 km/hour along transects through open grassland, the only habitat where Sharpe's Longclaw is known to occur. Seven transects were surveyed, over a total length of 5,750 m (Table 1, Fig. 1): four in Aberdare National Park (total length 3,850 m;

Table 1. Summary of transect location and habitat characteristics. Geographic coordinates identify the central points of each transect.
Tableau 1. Aperçu de la localisation des transects et des caractéristiques de l'habitat.
Les coordonnées géographiques indiquent le point central de chaque transect.

Location	Date	Length	Elevation	Coordinates (WGS84)		Grass height	Percentage cover of:				*M. sharpei* present
				North	East		Grass	Shrubs	Trees	Rocks	
Aberdare	8 Aug 08	1,050 m	3,057 m	00°24'27"	36°43'33"	120 cm	100	0	0	0	no
Aberdare	8 Aug 08	1,000 m	2,986 m	00°26'20"	36°43'29"	80 cm	95	5	0	0	no
Aberdare	9 Aug 08	900 m	2,918 m	00°31'24"	36°43'03"	150 cm	95	5	0	0	no
Aberdare	9 Aug 08	900 m	2,884 m	00°28'48"	36°43'55"	100 cm	95	5	0	0	no
Elgon	12 Sep 09	710 m	3,461 m	01°05'01"	34°37'20"	40 cm	93	5	2	0	yes
Elgon	12 Sep 09	750 m	3,224 m	01°04'34"	34°38'29"	30 cm	98	0	2	0	no
Elgon	12 Sep 09	440 m	2,777 m	01°03'12"	34°43'25"	70 cm	70	0	0	30	no

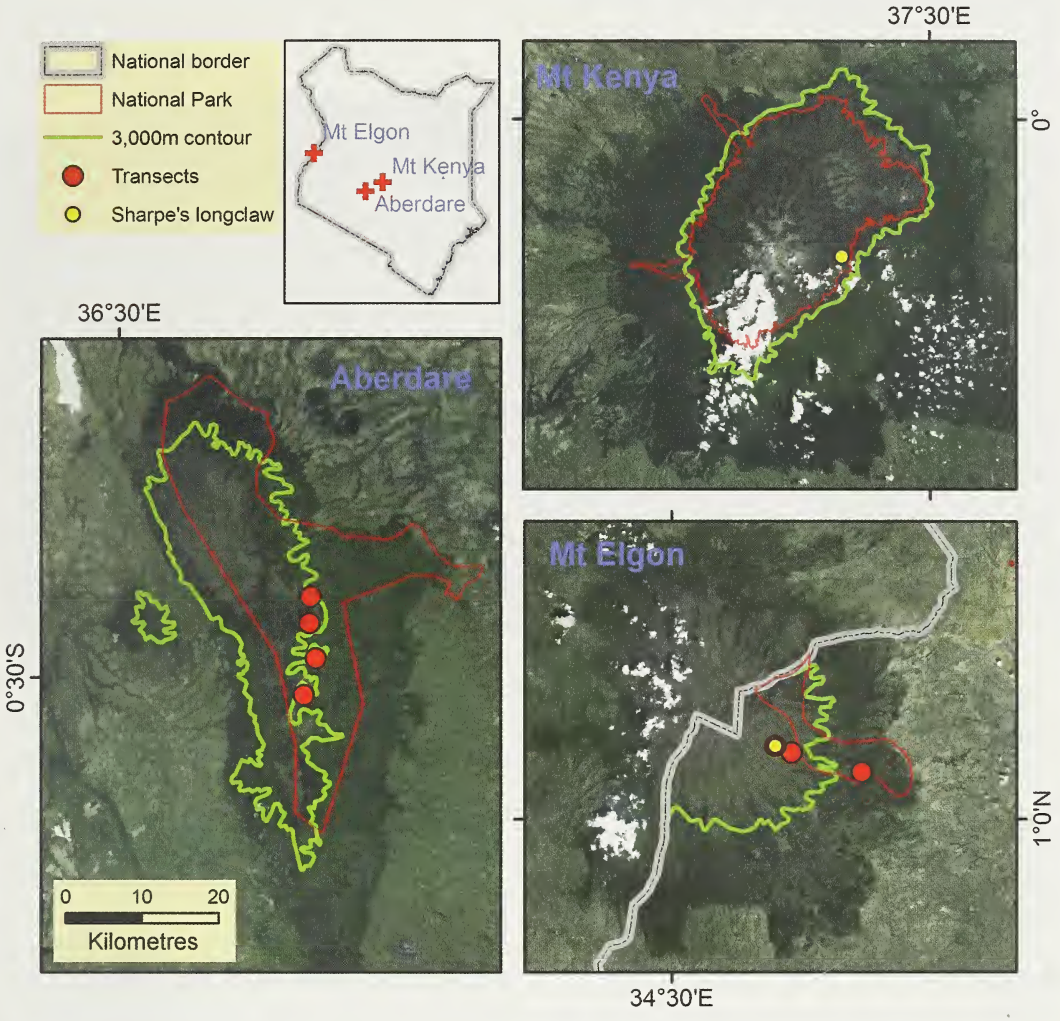

Figure 1. Satellite views of the three study areas. Dark green = montane forest; paler areas above the forest (>3,000 m) = altimontane habitats; those located below the forest are agricultural landscapes.

Images satellitaires des trois zones d'étude. Vert foncé = forêt de montagne ; zones plus pâles au-dessus de la forêt (>3.000 m) = habitats afroalpins ; les zones au-dessous de la forêt sont des zones agricoles.

elevation 2,884–3,057 m, mean 2,961 m) and three on Mount Elgon (total length 1,900 m; elevation 2,777–3,461 m, mean 3,153 m). Mean length of transects was 963 ± 75 m (s.d.) in Aberdare, and 633 ± 168 m (s.d.) on Mount Elgon, translating into a total of 19.3 ha of grassland surveyed in Aberdare and 9.5 ha on Mount Elgon. In order to flush concealed birds, a 50 m-long rope whose ends were held by two observers was dragged over the grass (Muchai *et al.* 2002). All counts were made by 3–4 observers, and the coordinates of the start and end points of each transect were recorded using a GPS (Table 1). In each transect, grass height was measured at 100 m intervals along the central line of the transect. Other relevant habitat features were also recorded for the transect as a whole, namely habitat composition (percentage of grassland, shrubs, bare rocks and trees within the surveyed area), signs of fire, bush encroachment, and evidence for the presence of wild or domestic herbivores.

Additional observations were made during an avifaunal survey of the southern side of Mount

Figure 2. Altimontane grassland in Aberdare National Park. The photograph shows tall grass, unsuitable for Sharpe's Longclaw *Macronyx sharpei*, and bush encroachment in the background (Luca Borghesio)

Prairie afroalpine dans le Parc National d'Aberdare. La photo montre des hautes herbes, qui ne conviennent pas à la Sentinelle de Sharpe *Macronyx sharpei* et, en arrière-plan, l'envahissement des arbustes (Luca Borghesio)

Kenya National Park on 10–11 March 2009. During this visit Sharpe's Longclaw was not the principal focus of study, therefore no standardised transect counts were performed.

Results

No Sharpe's Longclaws were found in Aberdare National Park. Grass height in the transects was 80–150 cm (mean 107 cm). No traces of recent fires were observed in the area covered by the transects, and ongoing bush encroachment was recorded at all sites visited.

On Mount Elgon, two Sharpe's Longclaws were observed at 3,490 m, in a grassland with signs of fire (charred logs on the ground; Fig. 2). The location was *c.*3 km outside the national park, which protects only a small proportion (*c.*15%, Fig. 1) of the Altimontane habitat on the Kenyan side of Mount Elgon. Grass height in the transects was 30–70 cm (mean 53 cm) and bush encroachment was recorded in all of them.

On Mount Kenya, three Sharpe's Longclaws were observed on 10 March 2009, in tussock grassland at 3,592 m (Fig. 1). Grass was estimated to be 30 cm high, and the site showed traces of a fire.

Discussion

Our survey demonstrated that Sharpe's Longclaw persists on at least two of the three high mountains in Kenya. Its presence on the Aberdare Range could not be confirmed, but this possibility should not be excluded yet, as our survey only covered a small part of the Altimontane habitat in the area (Fig. 1).

This study suggests that, in Altimontane grasslands, individual densities are low. On Mount Elgon, two birds (probably a pair) were observed in 9.5 ha of grassland (0.21 individuals / ha), while on Mount Kenya, where no standardised transect count was carried out, the abundance of the species was presumably also low, as only two individuals were seen in four days of field work in the Altimontane zone. In contrast, density estimates in lower altitude grasslands (<2,600 m) reveal that short-grass tussock grassland can support from 1.4 individuals / ha (Muchai *et al.* 2002) to 2.2 individuals / ha

Figure 3. The field team performing rope-dragging transect counts on Mount Elgon at the site where two Sharpe's Longclaws *Macronyx sharpei* were observed on 12 September 2009. The red arrow points to a burnt tree on the ground. Notice the short, tussocky grass, favourable for Sharpe's Longclaw (Luca Borghesio)

L'équipe de terrain réalisant des comptages de transect en traînant une corde sur le site au Mont Elgon où deux Sentinelles de Sharpe *Macronyx sharpei* ont été observées le 12 septembre 2009. La flèche rouge indique un arbre brûlé au sol. Noter les touffes d'herbe basse, favorables à la Sentinelle de Sharpe (Luca Borghesio)

(Ndang'ang'a *et al.* 2003). Therefore, population density in Altimontane habitats appears lower than that observed in optimal sites, although we acknowledge that our survey was conducted over a short temporal frame, and therefore we cannot exclude the possibility that population densities might be higher if seasonal movements occur during other months. However, if densities of Sharpe's Longclaw in Altimontane grasslands are genuinely lower than those observed at lower altitudes, this may partially reflect the climatic characteristics of the Altimontane zone, e.g. lower temperatures and different rainfall regime, but we also found that, at least at the time of our survey, grass height (mean 107 cm in the Aberdare Range, 53 cm on Mount Elgon) was higher than the optimum for Sharpe's Longclaw, which is <30 cm (Muchai *et al.* 2002). As well as suboptimal grass height, another limiting factor to populations of Sharpe's Longclaw in high mountains may be shrub encroachment, which was observed at all the sites. While a precise assessment of the extent of Altimontane grasslands on Kenyan mountains would require a more detailed study, it appears that only a minority, probably no more than 10%, of the area above the treeline is covered by grasslands, while the rest is shrubland, thicket and dwarf forest. Despite this, even accepting the low densities that we observed, Altimontane grasslands might prove to be important habitats for Sharpe's Longclaw. In fact, assuming mean densities of 0.2 individuals / ha and that grasslands comprise *c.*10% of the Altimontane zone, there is possibly *c.*2,000 ha of grasslands above 3,000 m on Mount Elgon and *c.*5,000 ha on Mount Kenya. This translates to *c.*400 individuals of Sharpe's Longclaw on Mount Elgon, and 1,000 on Mount Kenya.

At the sites where Sharpe's Longclaw was observed on Mount Elgon and Mount Kenya signs of 1–5-year-old fires were observed—inferred because fire-scarred logs, but no ashes or burnt twigs, were observed on the ground at both sites. Various authors have suggested that Altimontane grasslands are a fire-maintained habitat in East Africa (Hedberg 1951, Schmitt 1991) and

recently burnt areas covered by luxuriant short-grass swards have been reported on Mount Elgon (Ekkens 1988). While most fires nowadays are started by people (Wesche *et al.* 2000, Hemp 2006), paleoecological data show that low-intensity fires have occurred in the Altimontane zone of the East African mountains since at least the last glacial maximum (>18,000 years BP) and that grasslands in this zone show some adaptations to burning (Wooller *et al.* 2000). This suggests that fire has long been an important component in the maintenance of habitat diversity in the Altimontane zone (Wesche *et al.* 2000, Wesche 2002). Moreover, it appears that the grazing of wild mammals alone is insufficient to maintain Altimontane grasslands, because where fires are successfully prevented, as is currently the case in Aberdare National Park, rapid bush encroachment occurs (Thenya 2011). We propose that Sharpe's Longclaw could be a fire-dependent species at the upper end of its altitudinal range, because, in the absence of fire, grassland is encroached by shrub and bushland.

The use of controlled fire might represent an important tool to conserve Sharpe's Longclaw in the Altimontane zone. However, at present, fire management in Kenyan national parks consists exclusively of fire-fighting and prevention. In the 1960s and early 1970s, the authorities of Aberdare National Park used annual controlled early burning to reduce the danger of hot (intense) burns occurring in Altimontane habitats, but this practice has been discontinued. Recent fire prevention has been very successful, with an electrified fence nearly 400 km long, constructed in 1989–2009, around the entire perimeter of the park. In consequence, land cover in the park has undergone a marked transition: between 2000 and 2010 satellite images reveal a 9% decrease in the extent of moorlands (dominated by dwarf shrubs) and a 54% decrease of grasslands in the Altimontane zones (Thenya 2011), with these areas being occupied by increasing woodlands and montane forest.

On the other hand, on Mount Kenya and Mount Elgon, prevention is enforced less effectively, and fires still occur (Wesche *et al.* 2000, Anon. 2012). However, these fires are relatively low-frequency events, and tend to be very hot due to the build-up of fuel on the ground. Hot fires can be very damaging, and vegetation recovery, including that of grass tussocks, is impaired thereafter (Wesche 2002). The results of our survey suggest the hypothesis that both the absence of fires, and infrequent, hot fires, will promote loss of the short-grass tussock grassland on which Sharpe's Longclaw depends. On the contrary, more frequent, controlled fires will have lower temperatures and favour the expansion of short-grass tussock grasslands, which are the preferred habitat of Sharpe's Longclaw and also provide important foraging for large mammalian grazers. Appropriate fire management has already pinpointed as a key issue in the conservation of grassland birds in other regions, e.g. North America (Brawn *et al.* 2001) and South Africa (Parr & Chown 2003) We propose that this hypothesis urgently needs field testing with a more in-depth study than ours.

In conclusion, we showed that, several decades after their initial discovery, populations of Sharpe's Longclaw persist on at least two of the three highland massifs in Kenya. On Mount Kenya, the species occurs within the national park, which is therefore the only government protected area where the species currently occurs. On Mount Elgon, Sharpe's Longclaw was observed close to but outside of the park, which should ideally be enlarged to include a larger area of Altimontane grasslands. More work is necessary in Aberdare National Park to clarify the species' status there.

The persistence of Sharpe's Longclaw in Altimontane grasslands is important because human activities and land-use change are relatively limited in these areas, thus reducing threats to the species' survival. However, we hypothesise that lack of fire management could be degrading the quality and extent of Altimontane Sharpe's Longclaw habitat by promoting bush encroachment and suboptimally tall grass. Future research should more formally test the hypothesis that Sharpe's Longclaw is fire-dependent in Altimontane grasslands, and evaluate whether the long-abandoned practice of early dry season controlled fires should be resumed to expand short-grass tussock grasslands and to avoid catastrophic hot fires caused by fuel build-up.

Acknowledgements

This survey was funded by grants awarded by the British Ecological Society, the Conservation Fund of the African Bird Club and by the Royal Society for the

Protection of Birds' Research Fund for Endangered Birds. We thank the Kenya Wildlife Service for permitting access to Mount Kenya, Aberdare and Mount Elgon National Parks, the Department of Zoology of the National Museums of Kenya, and Dominic Kimani, James Maina, Samuel Bakari, Marco Arigò, Shiv Kapila, Jeff Mwangi, Peter Mungai and Patrick Gichuki for taking part in the field work. Thanks are also due to Prof. Luc Lens and Dr Leon Bennun for their comments on the submitted version of the paper.

References

Anon. 2012. Fire devours Kenya's ancient forests. www.aljazeera.com/news/africa (accessed 1 July 2012).

BirdLife International. 2012. Species factsheet: Sharpe's Longclaw (*Macronyx sharpei*). www.birdlife.org (accessed 1 July 2012).

Brawn, J. D., Robinson, S. K. & Thompson, F. R. 2001. The role of disturbance in the ecology and conservation of birds. *Ann. Rev. Ecol. Syst.* 32: 251–276.

Britton, A. J. & Sugg, J. 1973. Birds recorded on the Kimilili track, Mt. Elgon, Kenya. *J. East Afr. Nat. Hist. Soc. Natl. Mus.* 143: 1–7.

Ekkens, D. 1988. Fire and regrowth on Mount Elgon. *Swara* 11: 30–31.

Hedberg, O. 1951. Vegetation belts on East African mountains. *Svensk. Bot. Tidskr.* 45: 140–202.

Hemp, A. 2006. The impact of fire on diversity, structure and composition of the vegetation on Mt. Kilimanjaro. In Spehn, E. M., Liberman, M. & Körner, C. (eds.) *Land Use Change and Mountain Biodiversity*. Boca Raton, FL: CRC Press.

Lens, L., Bennun, L. A. & Duchateau, L. 2001. Landscape variables affect the density of Sharpe's Longclaw *Macronyx sharpei*, a montane grassland specialist. *Ibis* 143: 674–676.

Meinertzhagen, R. 1937. Some notes on the birds of Kenya Colony, with special reference to Mount Kenya. *Ibis* 79: 731–760.

Muchai, M., Lens, L. & Bennun, L. 2002. Habitat selection and conservation of Sharpe's longclaw (*Macronyx sharpei*), a threatened Kenyan grassland endemic. *Biol. Conserv.* 105: 271–277.

Ndang'ang'a, K., Mulwa, R. & Gichuki, P. 2003. A survey of the highland grassland endemics in Mau Narok / Molo Important Bird Area, Kenya. *Bull. ABC* 10: 64–67.

Ndang'ang'a, P. K., du Plessis, M. A., Ryan, P. G. & Bennun, L. 2002. Grassland decline in Kinangop Plateau, Kenya: implications for conservation of Sharpe's Longclaw (*Macronyx sharpei*). *Biol. Conserv.* 107: 341–350.

Parr, C. L. & Chown, S. L. 2003. Burning issues for conservation: a critique of faunal fire research in southern Africa. *Austral Ecol.* 28: 384–395.

Schmitt, K. 1991. *The Vegetation of the Aberdare National Park, Kenya*. Innsbruck: Universitätsverlag Wagner.

Thenya, T. (ed.) 2011. *Environmental, Social and Economic Assessment of the Fencing of the Aberdare Conservation Area*. Rep. to The Kenya Wildlife Service, Kenya Forest Service, Kenya Forests Working Group, United Nations Environment Programme and Rhino Ark. Nairobi: Biotope Consultancy Services.

Wesche, K. 2002. The high-altitude environment of Mt. Elgon (Uganda, Kenya): climate, vegetation, and the impact of fire. *Ecotropica Monogr.* 2.

Wesche, K., Miehe, G. & Kaeppeli, M. 2000. The significance of fire for afroalpine ericaceous vegetation. *Mountain Res. & Develop.* 20: 340–347.

White, F. 1983. *The Vegetation of Africa: A Descriptive Memoir to Accompany the UNESCO / AETFAT / UNSO Vegetation Map of Africa*. Paris: UNESCO.

Wooller, M. J., Street-Perrott, F. A. & Agnew, A. D. Q. 2000. Late Quaternary fires and grassland palaeoecology of Mount Kenya, East Africa: evidence from charred grass cuticles in lake sediments. *Palaeogeogr. Palaeocl. Palaeoecol.* 164: 207–230.

Young, T. P. 1996. High montane forest and Afroalpine ecosystems. In McClanahan, T. R. & Young, T. P. (eds.) *East African Ecosystems and Their Conservation*. New York: Oxford University Press.

Zimmerman, D. A., Turner, D. A. & Pearson, D. J. 1996. *Birds of Kenya and Northern Tanzania*. Princeton, NJ: Princeton University Press.

[a] *Dept. of Biological Sciences, University of Illinois at Chicago, 845 W Taylor Street, 60607 Chicago, IL, USA. E-mail: borghesio@gmail.com (corresponding author).*

[b] *Dept. of Zoology, National Museums of Kenya, Nairobi, Kenya.*

[c] *BirdLife International Africa Partnership Secretariat, Nairobi, Kenya.*

Received 28 July 2011; revision accepted 8 November 2012.